Douglas PARTNERS

GROUNDED EXPERTISE

Specialist Advice

Report on Additional Geotechnical Investigation

Proposed Residential Development

5-7 Church & 42 Donald St, Nelson Bay NSW

Prepared for Fortezza Group Pty Ltd

Project 227295.02

12 September 2025

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Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

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Report on Additional Geotechnical Investigation
Proposed Residential Development
5-7 Church & 42 Donald St, Nelson Bay NSW

1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results from additional geotechnical investigation undertaken for the proposed residential development at 5-7 Church & 42 Donald St, Nelson Bay NSW (the site). The investigation was commissioned in a Services Order dated 31 July 2025 from Roberto Giammaria of Fortezza Group Pty Ltd and was undertaken in accordance with Douglas' proposal 227295.01.P.01.Rev0 dated 30 July 2025.

Douglas previously undertook a geotechnical investigation at the site in connection with the proposed development (Douglas, 2024a). That investigation comprised five cone penetration tests (CPT), five boreholes, laboratory testing of selected samples, and preliminary advice on the ground conditions, including engineering parameters for foundations and basement shoring. Douglas (2024a) also proposed further investigation to address data gaps across the site, refine geotechnical design parameters for piles and shoring walls, undertake additional soil aggressivity testing, and install groundwater monitoring wells to confirm the depth of groundwater.

Since the preparation of Douglas (2024a), amendments have been made to the proposed basement excavation. At that time, the proposed development incorporated a single-level basement along the western side of the site (finished floor level of about RL 20.5 AHD), transitioning to a two-level basement along the eastern portion (finished floor RL of about 17.5 AHD). Based on the most recent development drawings, it is understood that a two-level basement is proposed across the entire footprint of the site, with a finished floor level of about RL 18 AHD.

This report presents the findings of the additional investigation recommended in Douglas (2024a), including refinement of previously provided geotechnical parameters for shoring walls and foundations, together with updated advice reflecting the deeper basement excavation now proposed along the western extent of the site. The additional works comprised eight CPTs, two boreholes, installation of two groundwater monitoring wells, and laboratory testing of selected samples.

This report should be read in conjunction with Douglas (2024) which provides additional advice and recommendations for the proposed development.

2. Proposed development

With reference to the supplied architectural drawings, it is understood that the proposed residential development, will comprise the construction of a nine-storey residential apartment building with a two-level basement car park, as shown in Figure 1. Based on the supplied preliminary earthworks site sections, the level 2 basement has a proposed finished floor level of RL 17.7 AHD.

Based on supplied information, it is anticipated that cuts of up to about 7 m to 8 m would be required to facilitate the construction of the below ground car parking area, nominally excavations to about RL 17 AHD, depending on the basement two slab thickness. Excavations for pile caps (where proposed) and lift pits are expected to be locally deeper.

At the time of preparing this report, structural loads were not available, however, considering the proposed development and based on previous experience, the loads are expected to be relatively high.

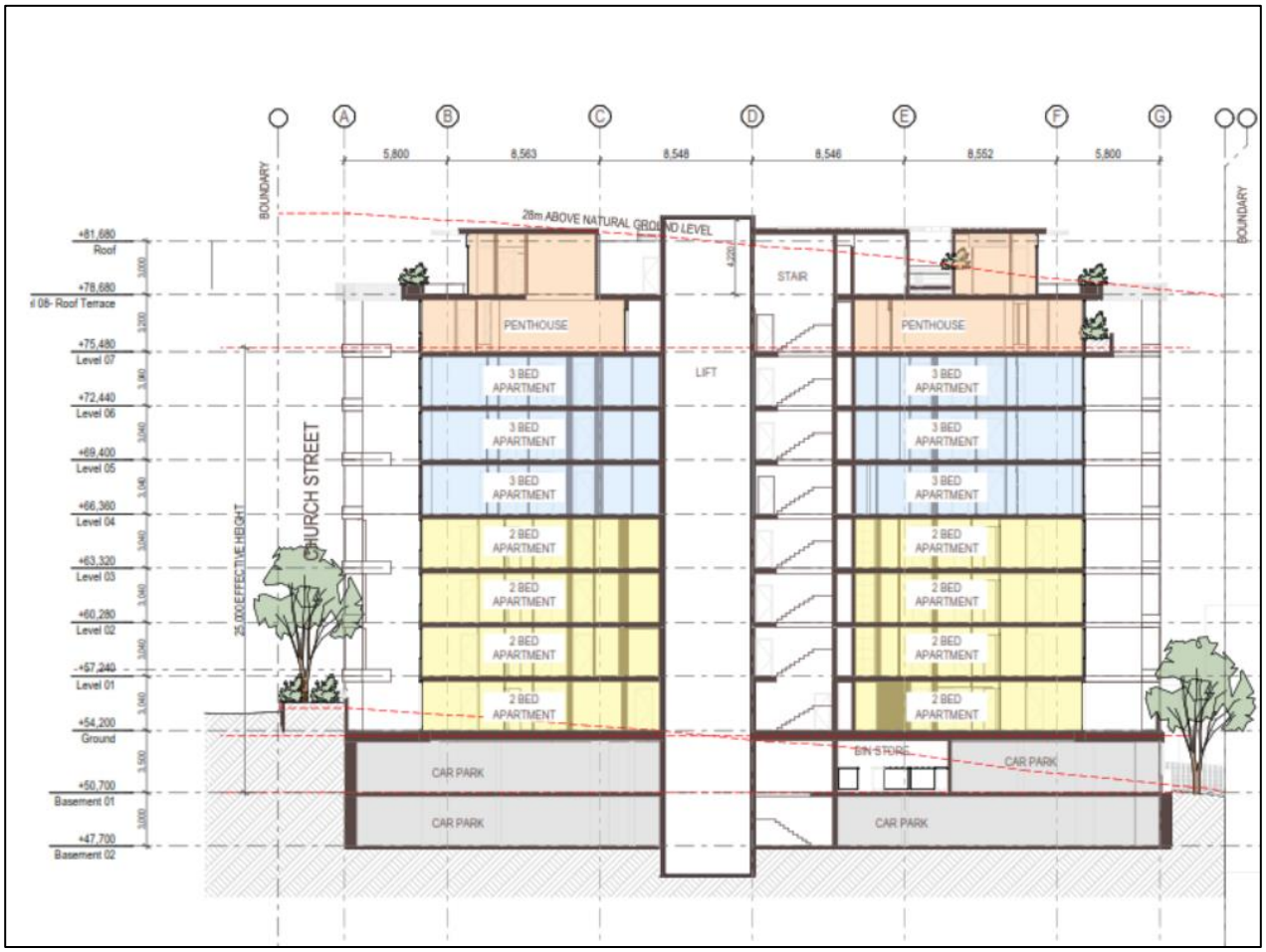

Figure 1: Section A Drawing TP501 from Hayes Anderson Lynch Architects Pty Ltd

3. Site description and published data

A general description of the site and relevant published data was previously provided in Douglas (2024a). Since that investigation, demolition works have been completed at Lot 15 DP 5616, including removal of the existing dwelling, garage, a possible former outhouse, and established trees. Lots A and B DP 417172 have remained largely unchanged, apart from the removal of trees along the boundary of Lot A. In addition, a boundary fence has been erected around Lot A and Lot 15 along Donald and Church Streets.

Details of the site and its surroundings at the time of the geotechnical investigation are shown in Figure 2 to Figure 6.

Figure 2: North-east corner of Lot 15 looking south-west

Figure 3: North-west corner of Lot 15 looking south-east

Figure 4: South-west corner of Lot A looking north-east

Figure 5: South-east corner of Lot A looking north-west

Figure 6: South-east corner of Lot B looking west

4. Field work

4.1 Field work methods

4.1.1 General

The fieldwork comprised the following:

- Eight CPTs (designated CPTs 401 to 408) to depths between 7.48 m and 19.06 m during the period of 12 August 2025 to 13 August 2025;
- Drilling of two geotechnical bores (designated Bores 201 and 203) to depths of 12 m and 10.1 m respectively during the period of 28 August 2025 to 29 August 2025. It is noted that Bores 201 and 203 were drilled in conjunction with additional site investigation being completed by Douglas as part of further contamination assessment for the proposed development. Details of these other bores are reported separate to this report; and
- The installation of groundwater wells in both bores using 50 mm diameter flush threaded Class 18 PVC.

The test locations were set out by an environmental engineer taking into consideration the existing services on site and within accessible areas. The environmental engineer also logged the subsurface profiles in the bores and collected representative samples for identification and laboratory testing purposes.

The tested / drilled locations were recorded using a differential GPS, which is typically accurate to ±0.1 m, depending on satellite coverage and site condition. The approximate location (GDA2020 Zone 56) and elevation (AHD) of the tests are shown on the attached CPT plots, borehole logs and Drawing 1 in Appendix D. It is important to note that Douglas is not a registered surveyor, hence the locations and elevations are approximate only.

4.1.2 CPTs

The CPTs were conducted using a purpose-built truck mounted CPT rig which required track mats to access parts of the site. A 35 mm diameter instrumented cone and friction sleeve assembly was hydraulically thrust into the soil at a rate of 2 cm / sec. Cone tip resistance, depth, sleeve friction and dynamic pore-water pressure were recorded by a computer data acquisition system for subsequent plotting and analysis. The remnant CPT holes were dipped to measure the depth to groundwater or hole collapse.

4.1.1 Boreholes

The bores were drilled using a specialised site investigation rig employing continuous push-tube methods. 'Disturbed' samples were collected for laboratory testing purposes.

Groundwater wells were installed in both bores using 50 mm diameter flush threaded Class 18 PVC using the drill rig. Well construction details are summarised in Table 1 and included on the borehole logs. Groundwater level monitoring is ongoing and will be reported in a separate report once completed.

Table 1: Well Construction Details

Bore/Well	Well Construction			
	RL Top of Casing (AHD)	Casing Radius (m)	Gravel Radius (m)	Screen Interval (m)
201	26.1	0.025	0.075	3.0 to 12.0
203	19.7			1.0 to 10.0

4.2 Results

The subsurface conditions inferred in the CPTs and encountered in the bores are detailed in the attached CPT plots and borehole logs in Appendix B. These should be read in conjunction with the notes on Appendix A, which explain the descriptive terms and classification methods.

The CPT plot includes an interpreted soil profile (soil behaviour type) based on published correlations between measured cone parameters and soil type. In this regard, it is difficult to distinguish between natural ground and fill, particularly if the fill is a similar material to the underlying natural ground. In the CPT descriptions, the depth of possible fill is shown but should be considered as approximate.

Unit 1 – Fill / Possible Fill: generally comprising sand / gravelly sand and / or silty sand with varying proportion of anthropogenic material including brick, tile and glass fragments and rootlets. Inferred to be variably compacted.

Unit 2 –Aeolian and Alluvial Sand

- Unit 2.1 – Sand and Silty Sand: generally loose or loose to medium dense. Some bands of indurated sand / cemented sand;
- Unit 2.2 – Sand and Silty Sand: generally medium dense or denser, locally very dense. Some loose or loose to medium dense bands. Some bands of indurated sand / cemented sand.

Table 3 summarises the subsurface conditions encountered at the site and includes the results from the previous Douglas (2024a) investigation.

Free groundwater was observed during drilling of Bore 203 at about 8 m depth. Gauging of the groundwater wells was also undertaken on 4 September 2025 and have been summarised in Table 2.

Table 2: Summary Groundwater Observations

Bore / Well	Depth to Groundwater (m)	Groundwater RL (AHD)
201	No groundwater observed	-
203	8.1	11.6

Table 3: Subsurface Summary

Soil Unit	Description	Base of Unit (m)																			
		Douglas (2024a)										Current investigation									
		CPT					Bore+					CPT								Bore+	
		1	2	3	4	5	6	7	8	9	10	401	402	403	404	405	406	407	408	201	203
1	Fill / Possibly Fill: Sand / Gravelly Sand / Silty Sand	0.4	0.55	0.55	0.15	0.25	0.1	0.1	0.1	0.6	0.1	0.19	0.52	0.24	0.27	0.24	0.42	0.41	0.33	0.15	0.2
2.1	Sand / Silty Sand: Loose or Loose to Medium Dense. Some bands of indurated / cemented sand.	2.0	2.3	2.0	7.3	1.7	6.0	6.0	6.0	6.0	6.0	2.0	1.4	6.3	2.0	1.9	2.0	2.1	2.0	12.0	10.1
2.2	Sand / Silty Sand: Medium Dense to Dense, become stronger with depth, locally very dense. Some loose or loose to medium dense bands. Some bands of indurated / cemented sand.	20.0	20.0	20.0	14.2	20.0						18.3	16.0	7.9	7.4	8.5	16.1	19.0	9.3		
Groundwater (m)*		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	15.7	13.6	NE	NE	NE	15.0	14.6	NE	NE	8.0
Limit of Investigation (m)		20.0	20.0	20.0	14.2	20.0	6.0	6.0	6.0	6.0	6.0	18.3	16.0	7.9	7.4	8.5	16.1	19.0	9.3	12.0	10.1

Notes to table:
NE – Not encountered
+ No strength data due to drilling method
*Groundwater observations in current CPT investigations have been inferred from pore pressure measurements during testing

5. Laboratory testing

Eight (8) samples were submitted to Envirolab Services Pty Ltd (Envirolab), a NATA accredited laboratory, for analysis of pH, electrical conductivity (EC), soluble sulfate (SO_4) and soluble chloride (Cl), to assess soil aggressiveness. Detailed laboratory report sheets are attached in Appendix C and are summarised in Table 4 along with the results of testing from Douglas (2024a).

Table 4: Results of Laboratory Soil Aggressivity Testing

Bore	Depth (m)	Sample Description	pH	EC (µS/cm)	Cl (mg/kg)	SO_4 (mg/kg)
201	4.0	Sand	5.5	6	<10	<10
201	6.0	Sand	5.8	3	<10	<10
201	8.0	Silty Sand (indurated)	5.0	15	<10	10
201	10.0	Sand	5.1	13	<10	10
203	4.0	Sand	7.8	10	<10	<10
203	6.0	Sand	6.1	4	<10	<10
203	7.0	Sand	6.6	8	<10	<10
203	9.0	Silty Sand (indurated)	6.5	14	<10	<10
6	0 – 0.1	Fill / Silty Sand	5.8	15	NT	NT
6	3.0	Sand	6.3	3	<10	<10
7	0 – 0.1	Fill / Silty Sand	5.4	11	NT	NT
8	0 – 0.1	Fill / Silty Sand	5.6	50	NT	NT
8	6.0	Sand	5.9	2	<10	<10
9	0 – 0.1	Fill / Silty Sand	6.3	42	NT	NT
9	0.5	Sand	7.1	20	NT	NT
10	0 – 0.1	Fill / Silty Sand	6.1	52	NT	NT
10	6.0	Silty Sand (indurated)	5.3	14	<10	10

Notes to table: µS – micro Siemens; Cl – Chloride Content; SO_4 – Sulfate Content; NT – Not tested

6. Comments

6.1 Appreciation of site and ground conditions

Based on the results of the CPTs and boreholes, the subsurface profile generally comprises granular fill overlying natural sand and silty sand, which is initially loose to medium dense but typically becomes medium dense to dense with depth. The boreholes indicated that excavations at the site are likely to encounter zones of indurated or cemented sand, however, the available investigation data suggests that this layer is unlikely to be continuous across the proposed development footprint. Where present, excavations within the indurated or cemented sand may require light ripping to assist with pick-up during bulk earthworks. In addition, the presence of indurated or cemented sand may lead to premature refusal of certain pile types (e.g. steel screw piles and sheet piles).

During the Douglas (2024a) investigation, it was noted that one of the CPTs located in the north-east of the site (CPT 4) indicated a comparatively weaker zone within the upper about 7 m to 8 m. Additional CPTs completed as part of the current investigation in this area confirmed similar behaviour, although the depth, extent, and severity of the weaker zone were observed to diminish when trending away from the north-eastern area of the site (refer Figure 7).

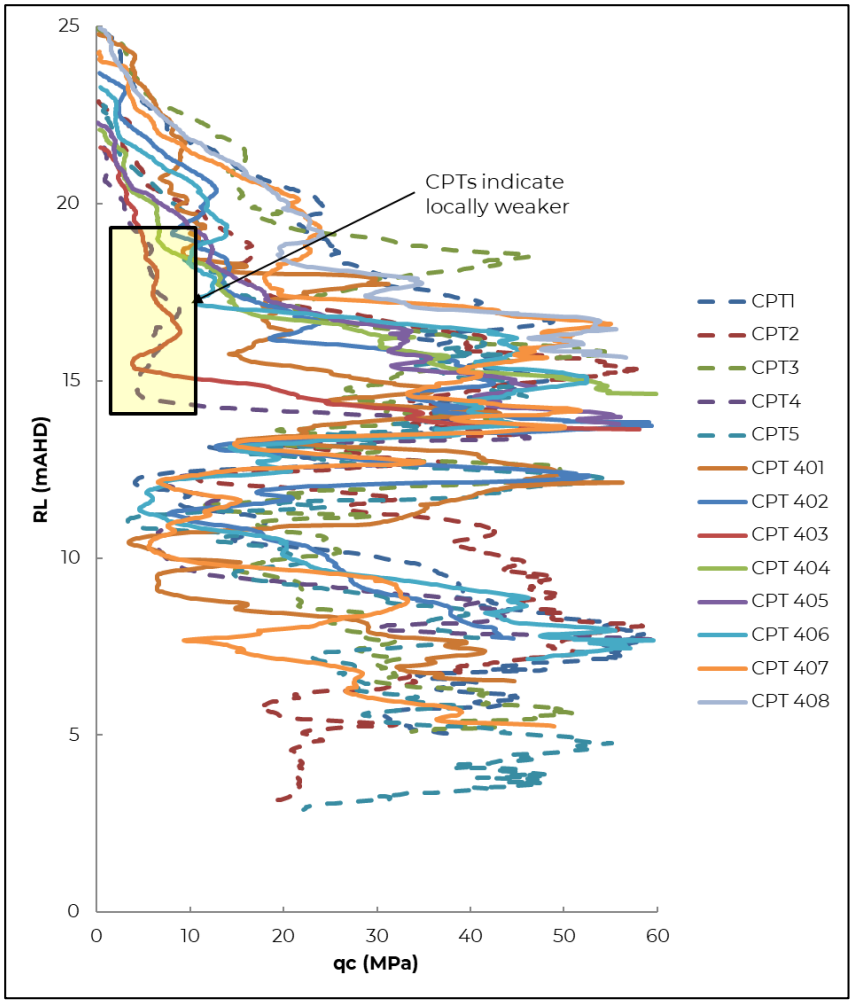

Figure 7: CPT tip resistance q_c vs RL

A review of historical aerial imagery (Figure 8 to Figure 15) and local site features (Figure 16 and Figure 17) suggests that slope creep or a historical localised instability may have occurred in the north-east part of the site. The available aerial imagery indicates the following:

- **2007, 2010 and 2015**: The fence line along the north-east boundary of Lot 15 appeared relatively straight. By 2015, an object or structure had been placed along the fence line;
- **2019**: The feature along the fence observed in 2015 had been removed, with bowing and displacement of the fence along the north-east boundary. A new fence had also been constructed along the northern boundary of the neighbouring property to the east;
- **2021**: The aerial image indicates misalignment of the fence along the northern extent of the neighbouring building. A large tree from the south-east corner of the northern neighbouring property has been removed;
- **2022**: Trees were removed from along the north-east boundary and from the neighbouring property to the north;
- **2023**: No obvious changes were noted;
- **2024**: Imagery suggests the development of a possible scarp behind the retaining wall on the neighbouring property;
- **2025**: No obvious changes were observed.

The combination of reduced strength indicated by the CPTs, likely attributable to a loss of confinement, together with observations from site inspections and aerial imagery, suggests that creep of the sand mass downslope and/or a localised historical slip failure may have occurred. While this appears to be a localised issue, it nevertheless presents implications for the performance of the foundation system and basement shoring in this part of the site, as well as a potential hazards to construction plant operating in the vicinity. In particular, heavy equipment such as piling rigs or cranes working upslope could remobilise the failure or accelerate creep movements, leading to instability of the plant and/or damage to the neighbouring property and the existing retaining wall to east of the site boundary. It is also possible that such creep or localised instability has already contributed to damage of the existing timber retaining wall located downslope on the adjoining eastern property.

Accordingly, it is proposed that a site-specific assessment and working platform thickness design be undertaken once details of the construction plant are confirmed. In addition, a dilapidation survey should be carried out prior to the commencement of site works, with particular attention given to the condition, construction type, and (where available) design details of the existing retaining wall along the eastern boundary. Whilst not forming part of the proposed development, it is noted that the proposed basement excavation and associated shoring system are expected to provide a net benefit to the existing downslope property and retaining wall. This benefit arises from the proposed shoring wall supporting the locally weaker soils, and from the bulk excavation reducing surcharge on the slope by removing overlying material.

Figure 8: MetroMap aerial image 2007

Figure 9: MetroMap aerial image 2010

Figure 10: MetroMap aerial image 2015

Figure 11: MetroMap aerial image 2019

Figure 12: MetroMap aerial image 2021

Figure 13: MetroMap aerial image 2022

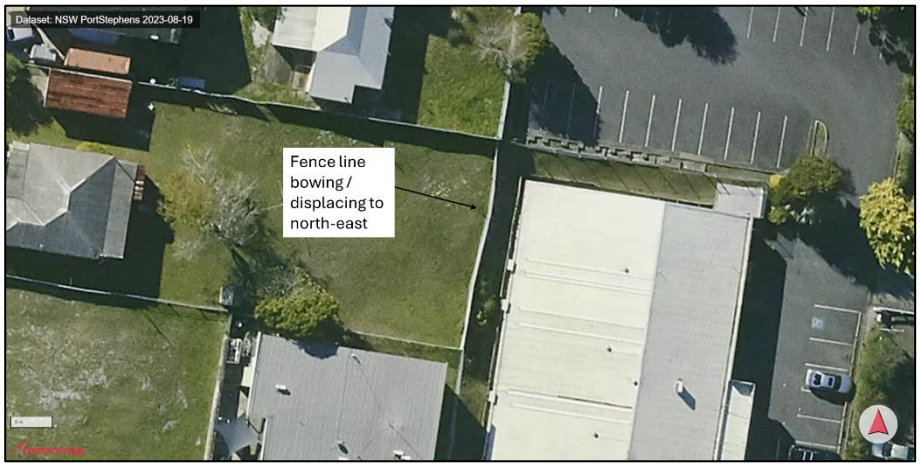

Figure 14: MetroMap aerial image 2023

Figure 15: MetroMap aerial image 2024

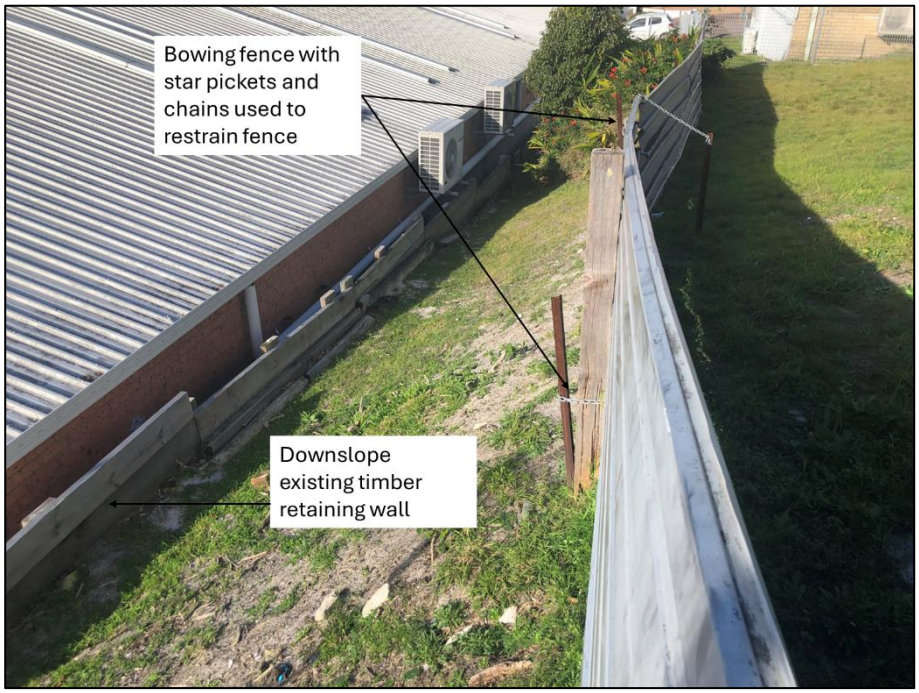

Figure 16: Looking south along fence line Douglas (2024a) investigation

Figure 17: Looking south along fence line current investigation

It is noted that the majority of the CPTs indicated that the sand is typically medium dense to dense from about RL 17, which generally coincides with the anticipated bulk excavation level. On this basis, it is considered that support of the building on a stiffened raft slab founded within the medium dense to dense sand could be a feasible option, depending on the tolerable total and differential settlements of the building. Alternatively, a piled raft foundation may also be considered, taking advantage of the medium dense sand layer, the relatively low net overburden pressures, and the ability to reduce pile lengths. Such a system may be particularly beneficial where column loads are high or concentrated, such as beneath building cores or in the north-east area of the site where the CPTs have indicated the ground conditions are locally weaker to about RL 14 AHD.

Douglas has previously undertaken a preliminary raft assessment for the proposed development (Douglas 2024b) and provided initial geotechnical parameters to enable the project structural engineer to assess the feasibility of a raft slab. Should a raft or piled raft slab be adopted as the foundation system, further detailed geotechnical analysis will be required to validate the assumptions of the preliminary assessment, to consider the locally weaker area of the site, undertake sensitivity checks and to provide refined estimates of total and differential settlements, as well as the modulus of subgrade reaction, for input to the structural design. Douglas would be pleased to provide further geotechnical input to support detailed assessment of the raft or piled raft foundation options.

6.2 Excavation support

Given that some CPTs have indicated a weaker layer in the north-east portion of the site, together with site observations and aerial imagery suggesting a historical localised instability and/or ongoing creep of the sand, and noting that CPT investigations in the south-east corner were precluded due to the presence of the existing building on Lot B, it is proposed that the shoring wall design along the eastern boundary and the eastern 20 m of the northern boundary adopt the revised retaining wall parameters presented in Table 5.

For all other walls, the retaining wall parameters previously outlined in Douglas (2024a) remain applicable. The parameters in Table 5 should be read in conjunction with Douglas (2024a), which provides further advice on shoring wall types, parameter assumptions, and additional general requirements for shoring wall design.

Table 5: Design parameters for retaining structures: Eastern and northern boundary walls in proximity to weak area

Unit	γ_b (kN/m^3)	ϕ' (deg)	K_a	K_o	K_p
Unit 1: - Fill / Possibly Fill: Sand / Gravelly Sand	20	30	0.33	0.50	3.00
Unit 2.1: - Sand / Silty Sand: Loose or Loose to Medium Dense	20	30	0.33	0.50	3.00
Unit 2.2: - Sand / Silty Sand: Medium dense or denser	20	34	0.28	0.44	3.54

Notes to table:
γ_b - bulk density
ϕ' friction angle
K_o - coefficient of 'at-rest' earth pressure
K_a - coefficient of active earth pressure
K_p - coefficient of passive earth pressure

6.3 Footing Systems

6.3.1 Shallow Footings

A revised assessment of shallow footings has been undertaken with reference to Douglas (2024a), the current investigation, site observations, historical aerial imagery, and the revised basement level for the proposed development. Shallow foundations should generally be founded within Unit 2.2 medium dense or stronger sand. However, both the previous and current investigations identified a locally weaker zone in the north-east of the site, extending to about 2 m to 3 m below the anticipated bulk excavation level.

For preliminary design, pad footings at least 1 m wide and up to 2.5 m square and strip footings at least 1 m wide, founded at least 1 m below the proposed basement level (i.e. about RL 16) within the medium dense or stronger sand, may be designed for an allowable bearing capacity of 300 kPa. This value is generally governed by the weaker soils indicated by the CPTs.

Settlements under this loading are expected to be in the order of 15 mm, however could be locally greater and up to about 30 mm in the north-east area of the site where weaker soils have been encountered.

Pad footings may still be considered for individual columns, provided loads are proportioned accordingly. However, the potential for differential settlements between columns with varying load combinations and ground conditions requires careful assessment. If pad footings are proposed for column support, further detailed geotechnical assessment will be necessary once column layouts and loadings are confirmed.

For lightly loaded structures that are not settlement sensitive, high level spread footings founded near the existing site surface, such as strip or pads may be used, provided they are proportioned in accordance with Table 6 below.

Table 6: Allowable bearing pressure for near surface footings

Founding Material	Footing Type	Minimum Embedment Depth (m)[1]	Maximum Allowable Bearing Pressure (kPa)
Engineered Fill or Unit 2.1 Sand / Silty Sand loose to medium dense or stronger	Pad - 1.0 m x 1.0 m	0.5	100
	Strip 0.5 m wide		

Notes to table: Footings may need be deeper to meet founding material requirements and depth of existing fill at the site

6.3.2 Piles

6.3.2.1 Geotechnical strength reduction factor

A revised assessment of the geotechnical strength reduction factor ϕ_g has been undertaken with reference to the piling standard AS 2159 (2009) considering the additional site investigation data and the identified geotechnical risks.

The revised assessment has indicated an average risk rating (ARR) of 2.69 (i.e low to moderate). The suggested geotechnical strength reduction factor (ϕ_g) is assessed to be 0.52 for low redundancy piles and 0.6 for high redundancy piles. Higher values of ϕ_g may be justifiable if sufficient load testing is conducted, as per AS 2159 (2009) and construction supervision / testing is undertaken but this will depend on the pile type and should be assessed by the piling contractor.

6.3.2.2 Geotechnical capacity of single piles

Considering the ground conditions and anticipated loading, and as previously noted in Douglas (2024a), continuous flight auger (CFA) piles are considered the most suitable foundation type for the proposed development. Revised estimates of ultimate shaft and end bearing capacities are presented in Table 7, incorporating the additional CPT data, the proposed bulk excavation level, the weaker zones identified in the CPTs in north-east of the site, weaker bands within the Unit 2.2 sand, and the influence of groundwater. Based on the results of the CPTs, piles should be founded within the dense or stronger Unit 2.2 sand, generally between about RL 10 AHD to 6 AHD. The piling contractor should consider the need for cased CFA piles, particularly if installed below the groundwater level or near site boundaries. Cased CFA piles reduce the risk of overflighting.

For CFA piles in tension, the shaft adhesion parameters should be reduced to 75% of the values in Table 7.

Table 7: Estimated Ultimate Geotechnical Pile Capacities for CFA Piles founded between RL 7 AHD to 4 AHD

Unit / Description	Ultimate Shaft Adhesion (kPa)	Ultimate End Bearing (MPa)
Unit 2.1: - Sand / Silty Sand: Loose or Loose to Medium Dense	1.5 H	-
Unit 2.2: - Sand / Silty Sand: Medium dense or denser	2.5 H	0.7 H $\leq$ 7 MPa

Notes to table: H is the depth to the pile to below the bulk excavation depth in metres. The ultimate end bearing capacity is the lesser of 0.7H or 7 MPa.

The foregoing estimated capacities relate to geotechnical strength only, and the structural adequacy of the piles must also be verified. In addition, prospective piling contractors should confirm that the proposed capacities and founding depths are achievable with their equipment under the prevailing ground conditions.

The parameters in Table 7 should be read in conjunction with Douglas (2024a), which provides further advice on parameter assumptions and additional general requirements for pile design, construction and testing.

6.4 Soil Aggressiveness

Considering the results of the current geotechnical investigation and laboratory testing, the ground conditions are assessed as corresponding to a moderate exposure classification for concrete and mildly aggressive conditions for steel, in accordance with the durability requirements for concrete and steel piles set out in AS 2159 (2009).

For shallow concrete and steel elements, typically located above the bulk excavation level and groundwater table, the laboratory test results indicate mildly aggressive conditions for buried concrete and non-aggressive conditions for buried steel.

7. References

AS 2159. (2009). *Piling - Design and Installation*. Standards Australia.

Douglas. (2024a). *Report on Preliminary Geotechnical Investigation, Proposed Residential Development, 5-7 Church Street and 42 Donald Street, Nelson Bay NSW*. Ref 227295.00.R.002.Rev0: Douglas Partners Pty Ltd.

Douglas. (2024b). *Report on Geotechnical Assessment, Proposed Multistorey Development, 5-7 Church Street and 42 Donald Street Nelsoon Bay NSW*. Ref: 227295.00.R.004.Rev0: Douglas Partners Pty Ltd.

8. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 5-7 Church & 42 Donald St, Nelson Bay NSW in line with Douglas' proposal 227295.01.P.001.Rev0 dated 30 July 2025 and acceptance received from Roberto Giammaria of Fortezza Group Pty Ltd dated 31 July 2025. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Fortezza Group Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during current and previous investigations. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical and groundwater components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed ‘safety in design’ assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

This report provides specialist advice only and no part of it is considered a Regulated Design under the Design and Building Practitioner Act 2020 (NSW).

Appendix A

About This Report

Terminology, Symbols and Abbreviations

Soil Descriptions

Sampling, Testing and Excavation Methodology

Cone Penetration Testing

About this Report

October 2024

Introduction

These notes have been provided to amplify Douglas' report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

Douglas' reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, Douglas will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, Douglas cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, Douglas will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, Douglas requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. Douglas would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style XW. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	KL
Unknown	Information was not available to allow classification of the property. For example, when augering in loose, saturated sand auger cuttings may not be returned.	UK
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	ND
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	NA

Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

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Soil Descriptions

Terminology
Symbols
Abbreviations

March 2024

Introduction

All materials which are not considered to be "in-situ rock" are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:

The "classification" comprises a two character "group symbol" providing a general summary of dominant soil characteristics. The "name" summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either "fine grained" (also known as "cohesive" behaviour) or "coarse grained" ("non cohesive" behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as "oversize"	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

[1] – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer "component proportions" below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a "Sandy CLAY", this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a "primary", "secondary", or "minor" component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition[1]	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to its engineering properties	All other components	All other components

[1] As defined in AS1726-2017 6.1.4.4

[2] In the detailed material description, minor components are split into two further sub-categories. Refer "identification of minor components" below.

Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, "INTERBEDDED Silty CLAY AND SAND".

Soil Descriptions

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component [1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type		Particle size (mm)
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 – 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code NDF, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example (VS).

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as "extremely weathered material" in reports and by the abbreviation code XWM on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than 'very low' as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Fluvial	Deposited by channel fill and overbank (natural levee, crevasse splay or flood basin)	FLV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be "oversize" may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with "MIXTURE OF".

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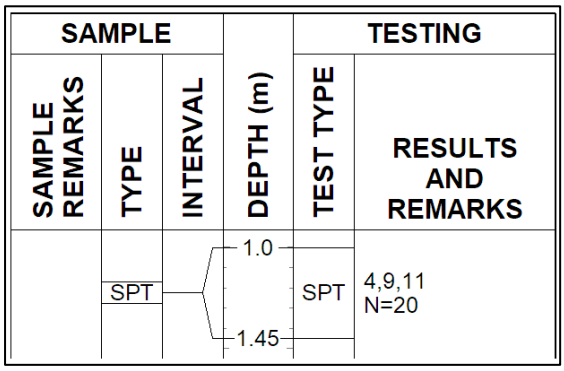
Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid Sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Environmental sample	ES
Driven Tube sample	DT
Gas sample	G
Piston sample	P
Sample from SPT test	SPT
Undisturbed tube sample	U[1]
Water sample	W
Material Sample	MT
Core sample for unconfined compressive strength testing	UCS

[1] – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y =*x* blows for *y* mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP9/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150
Dynamic probe super heavy, followed by blow count penetration increment in mm	DPSH/100

Groundwater Observations

	water seepage/inflow
	water seepage/outflow
	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Direct Push	DP
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD[1]
Air Track	AT
Diatube	DT[1]
Hand auger	HA[1]
Hand tools (unspecified)	HAND
Existing exposure	X
Hollow flight auger	HSA[1]
HQ coring	HQ3
HMLC series coring	HMLC
NMLC series coring	NMLC
NQ coring	NQ3
PQ coring	PQ3
Predrilled	PD
Push tube	PT[1]
Ripping tyne/ripper	R
Rock roller	RR[1]
Rock breaker/hydraulic hammer	EH
Sonic drilling	SON[1]
Mud/blade bucket	MB[1]
Toothed bucket	TB[1]
Vibrocore	VC[1]
Vacuum excavation	VE
Wash bore (unspecified bit type)	WB[1]

[1] – numeric suffixes indicate tool diameter/width in mm

Cone Penetration Testing

October 2024

Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance q_c
- Sleeve friction f_s
- Inclination (from vertical) i
- Depth below ground z

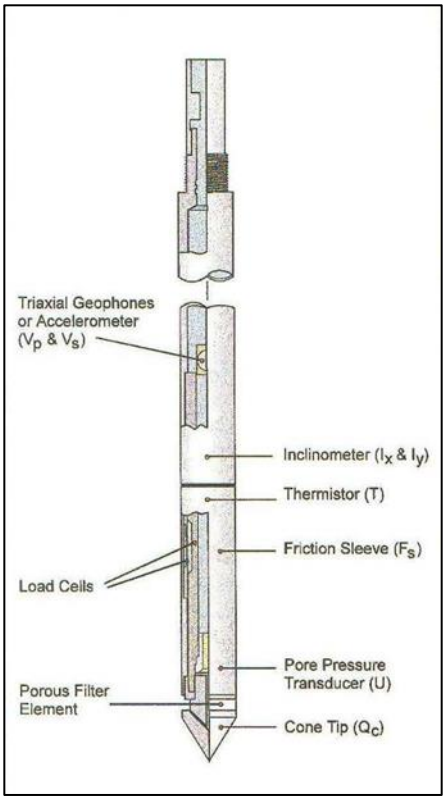


Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.

Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

Type	Measures
Standard	Basic parameters (qc, fs, i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (□) plus basic parameters
Seismic	Shear wave velocity (Vs), compression wave velocity (Vp), plus basic parameters

Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Qt) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

Cone Penetration testing

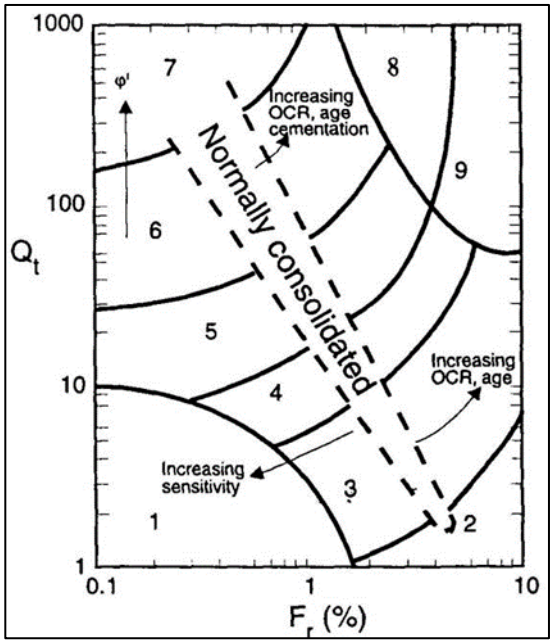


Figure 3: Soil Classification Chart

Douglas' in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

Douglas' CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

Settlement

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

Pile Capacity

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. Douglas' in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation.

The results are expressed in limit state format, consistent with the Piling Code AS2159.

Dynamic or Earthquake Analysis

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus G0. Techniques have also been developed relating CPT results to the risk of soil liquefaction.

Other Applications

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

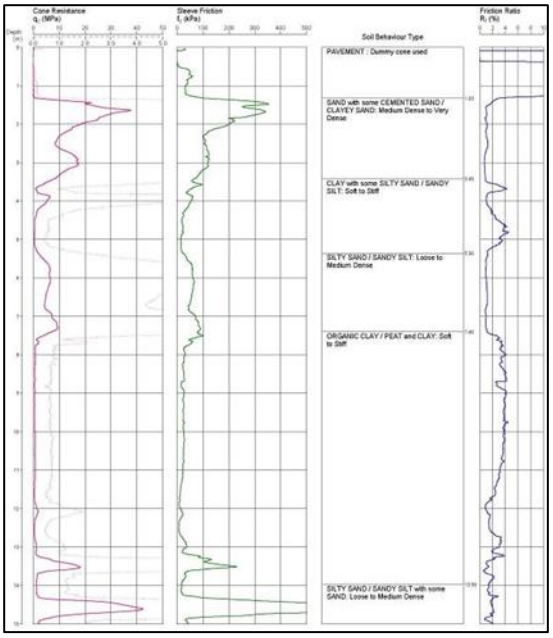


Figure 4: Sample Cone Plot

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Appendix B

Cone Penetrometer Test Plots (CPTs 1 to 5 and 401 to 408)

Borehole Logs (Bores 201 and 203)

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

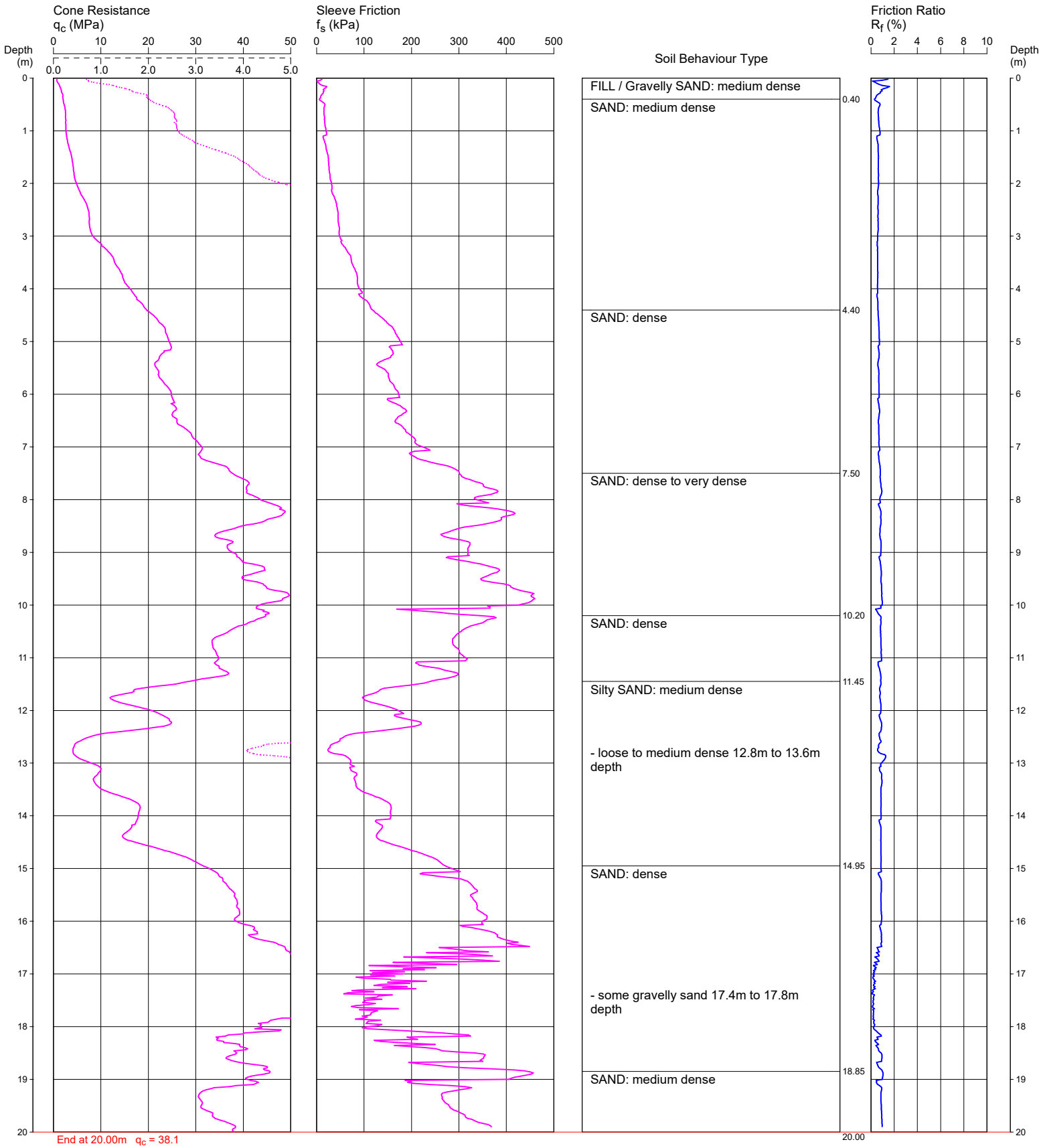
REDUCED LEVEL: 24.9 AHD

COORDINATES: 419557.4E 6379291.2N GDA20 Zone 56

CPT1

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST TERMINATED AT TARGET DEPTH
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT1.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

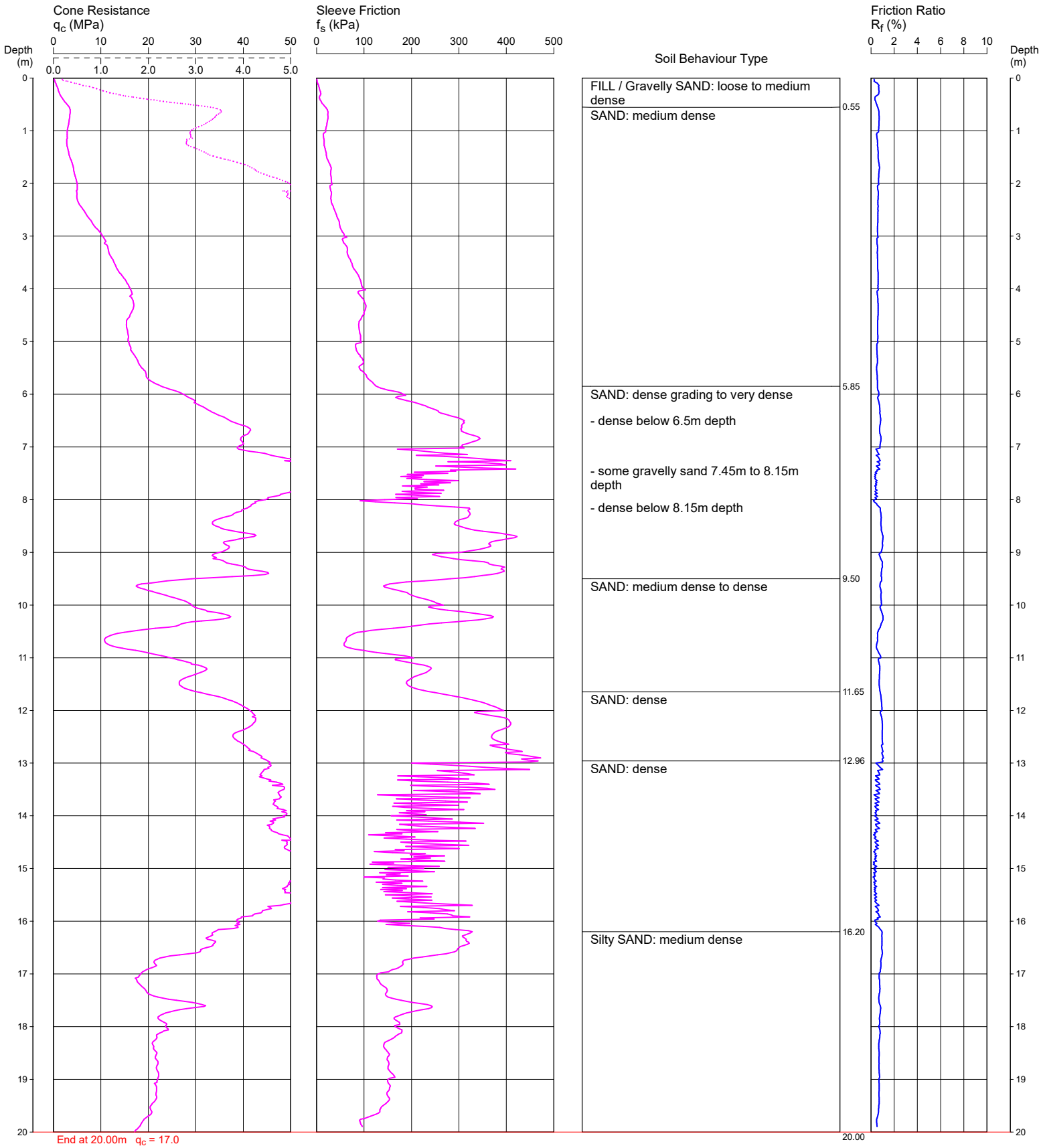
REDUCED LEVEL: 22.9 AHD

COORDINATES: 419580.6E 6379280.2N GDA20 Zone 56

CPT2

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST TERMINATED AT TARGET DEPTH
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT2.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

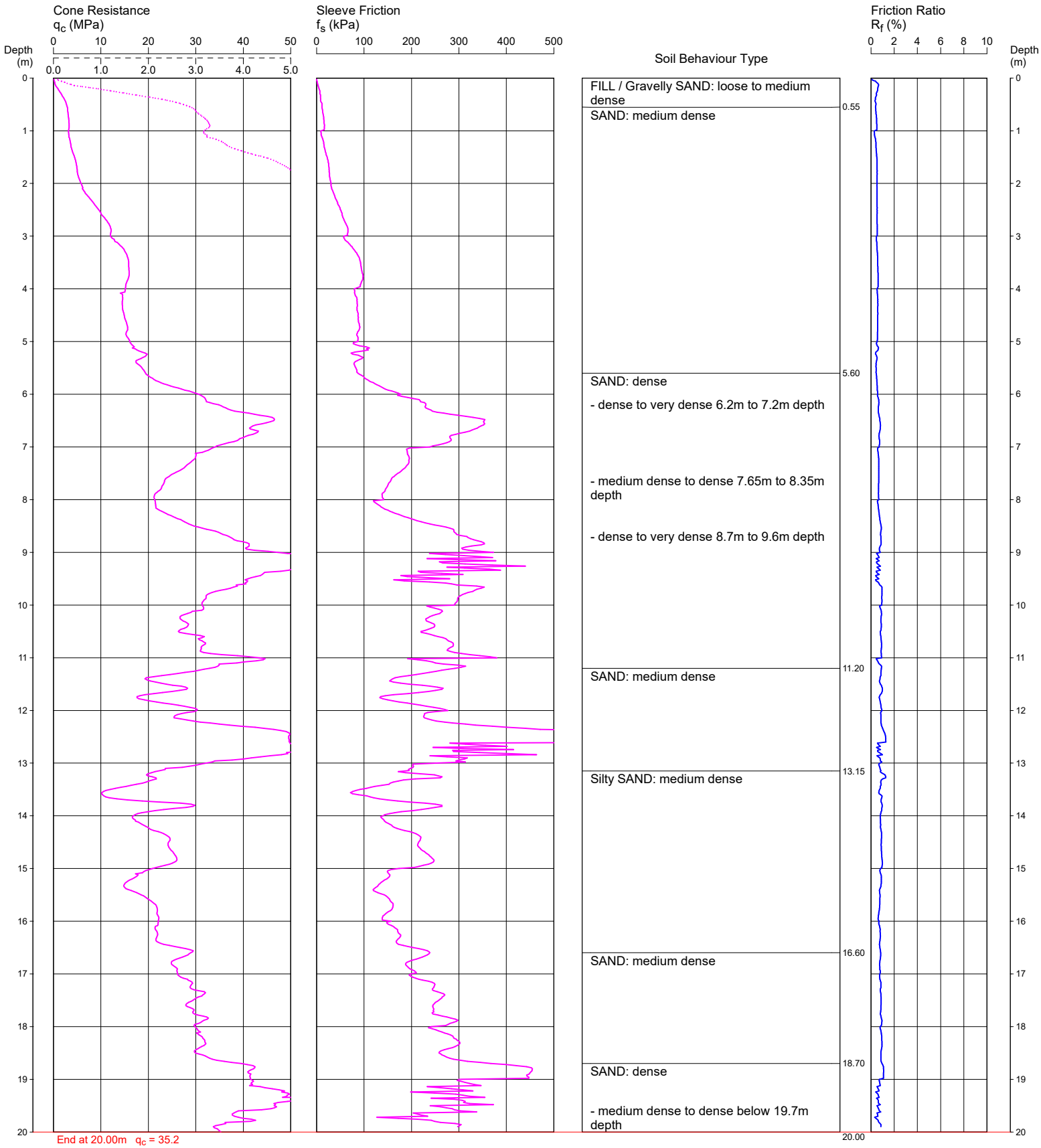
REDUCED LEVEL: 25.0 AHD

COORDINATES: 419547.8E 6379273.1N GDA20 Zone 56

CPT3

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST TERMINATED AT TARGET DEPTH
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT3.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

REDUCED LEVEL: 21.6 AHD

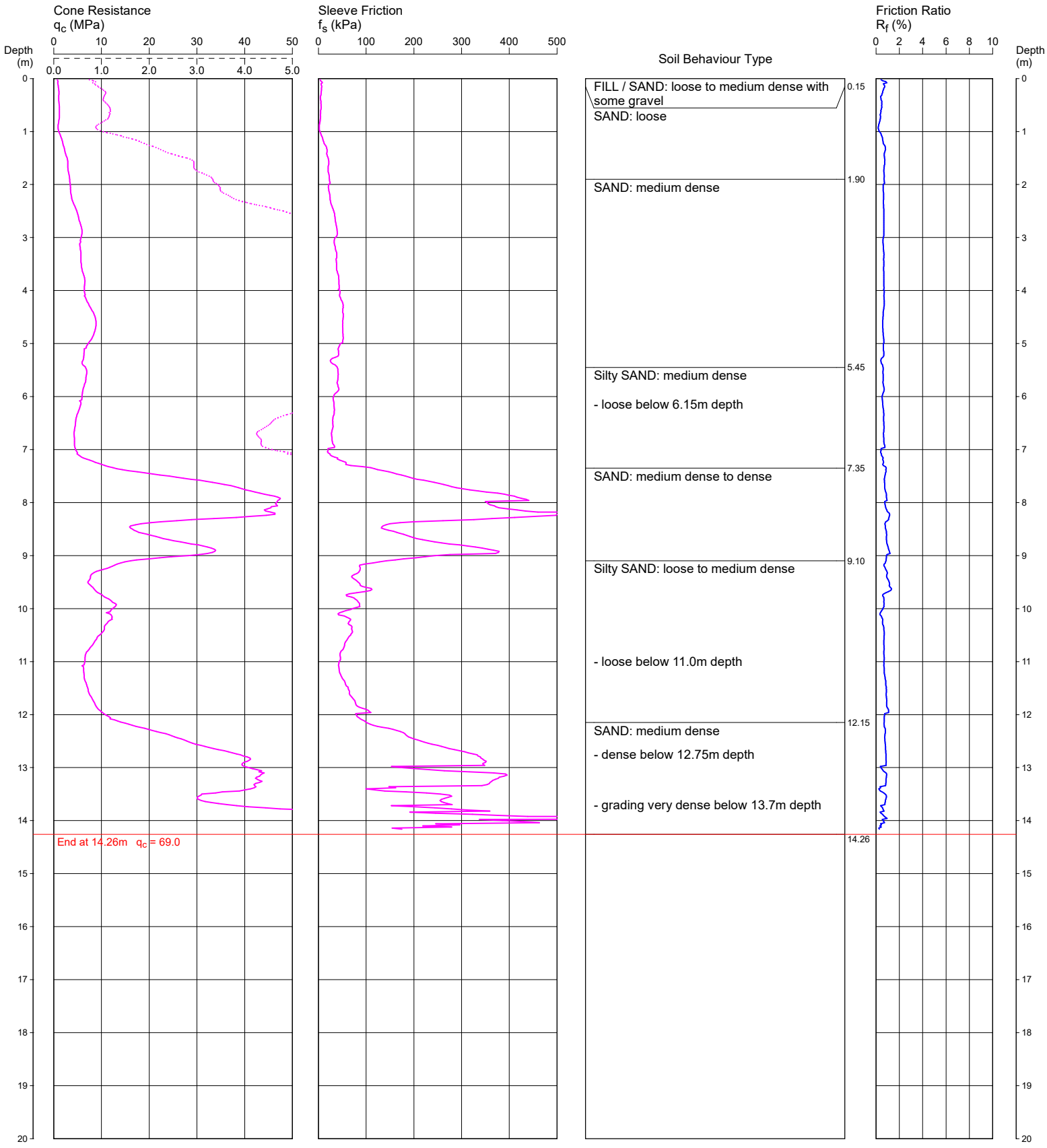
COORDINATES: 419594.6E 6379281.1N GDA20 Zone 56

CPT4

Page 1 of 1

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT4.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
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CONE PENETRATION TEST

CLIENT: FORTEZZA GROUP PTY LTD

PROJECT: PROPOSED DEVELOPMENT- THE BELVERDE

LOCATION: 5-7 CHURCH & 42 DONALD STREET, NELSON BAY

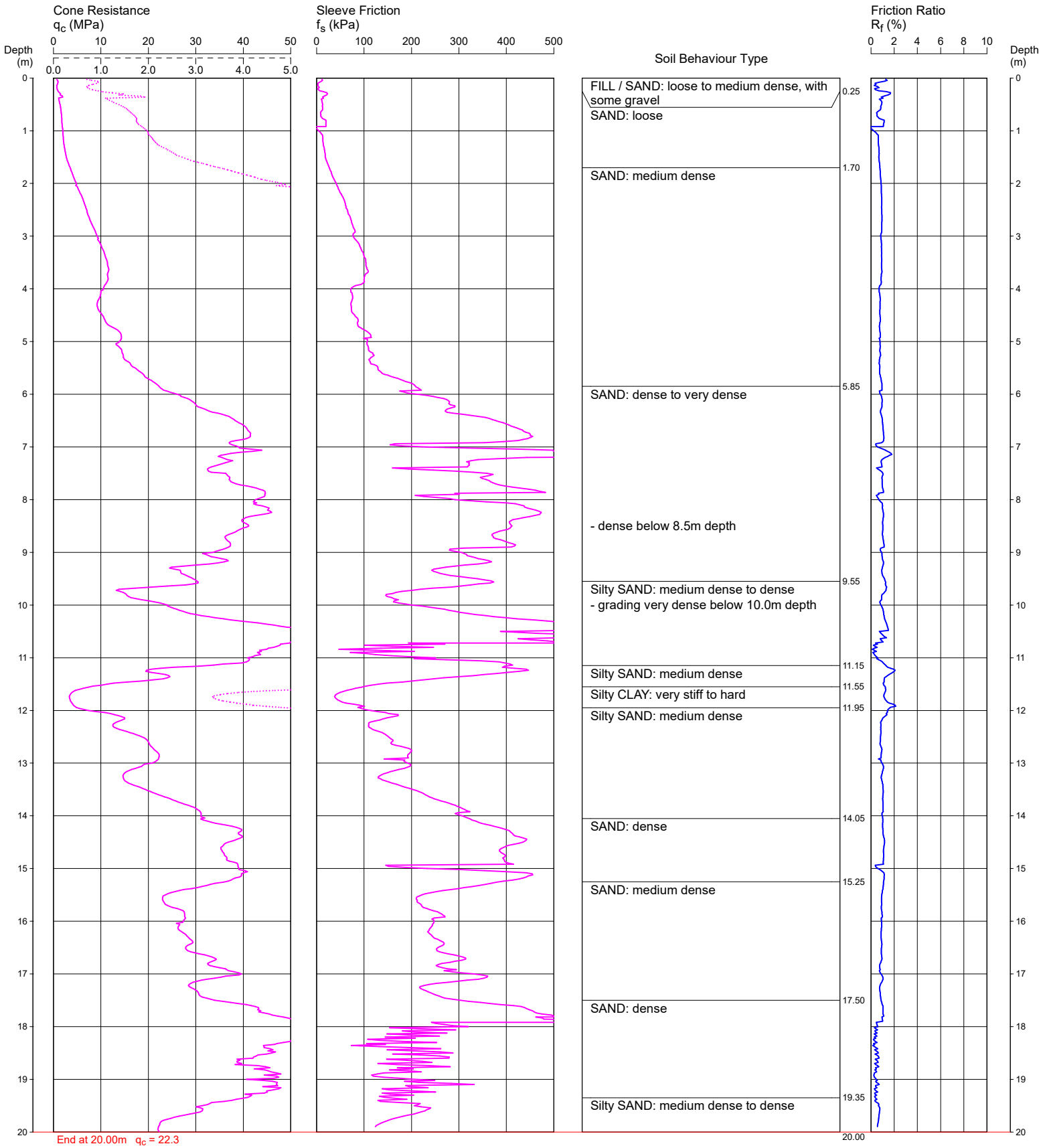
REDUCED LEVEL: 22.8 AHD

COORDINATES: 419566.5E 6379259.0N GDA20 Zone 56

CPT5

DATE 09/07/2024

PROJECT No: 227295.00



REMARKS: TEST TERMINATED AT TARGET DEPTH
NO GROUNDWATER OBSERVED UP TO 10.0M BGL AFTER WITHDRAWAL OF RODS

File: P:\227295.00 - NELSON BAY, 5-7 Church, 42 Donald St,Geo\4.0 Field Work\4.2 Testing\CPTs 09.07.2024\CPT5.CP5
Cone ID: 161226 **Type:** I-CFXY-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: Fortezza Group Pty Ltd

PROJECT: Proposed Multistorey Residential Development

LOCATION: 5-7 Church & 42 Donald Street Nelson Bay

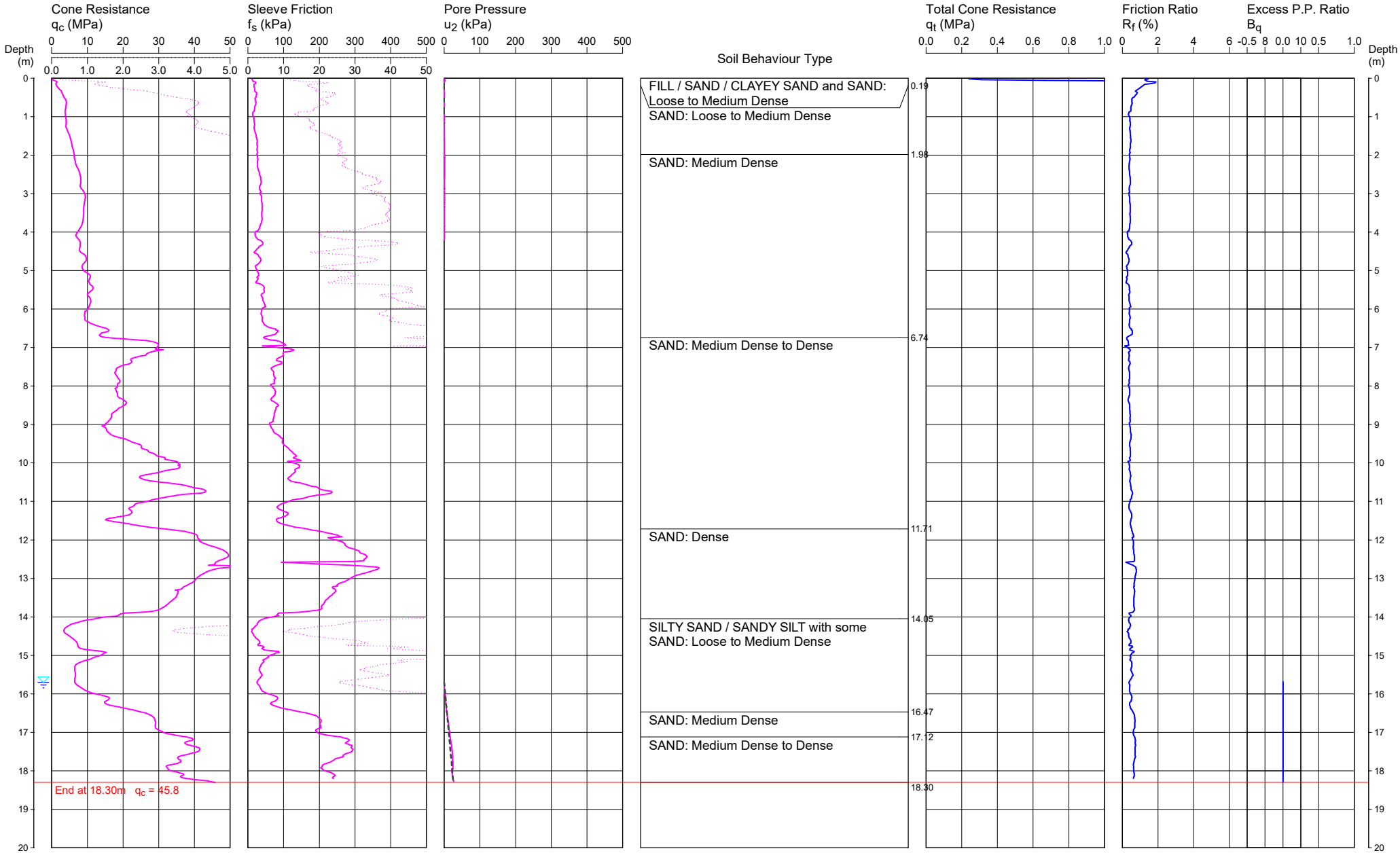
REDUCED LEVEL: 24.8 AHD

COORDINATES: 419545.4E 6379263.1N MGA2020 - Zone 56

401
Page 1 of 1

DATE 13/08/2025

PROJECT No: 227295.02



REMARKS: Hole discontinued due to cone tip refusal. Hole discontinued due to excessive rod string bowing. No water observed in CPT hole after withdrawal of rods. CPT hole open to at least 8 m depth after withdrawal of rods.

Water depth after test: 15.70m depth (assumed)

File: P:\227295.02 - NELSON BAY,5-7 Church & 42 Donald St,Geo\4.0 Field Work\4.2 Testing\401 (formerly 101).CP5
Cone ID: 220516 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: Fortezza Group Pty Ltd

PROJECT: Proposed Multistorey Residential Development

LOCATION: 5-7 Church & 42 Donald Street Nelson Bay

REDUCED LEVEL: 23.7 AHD

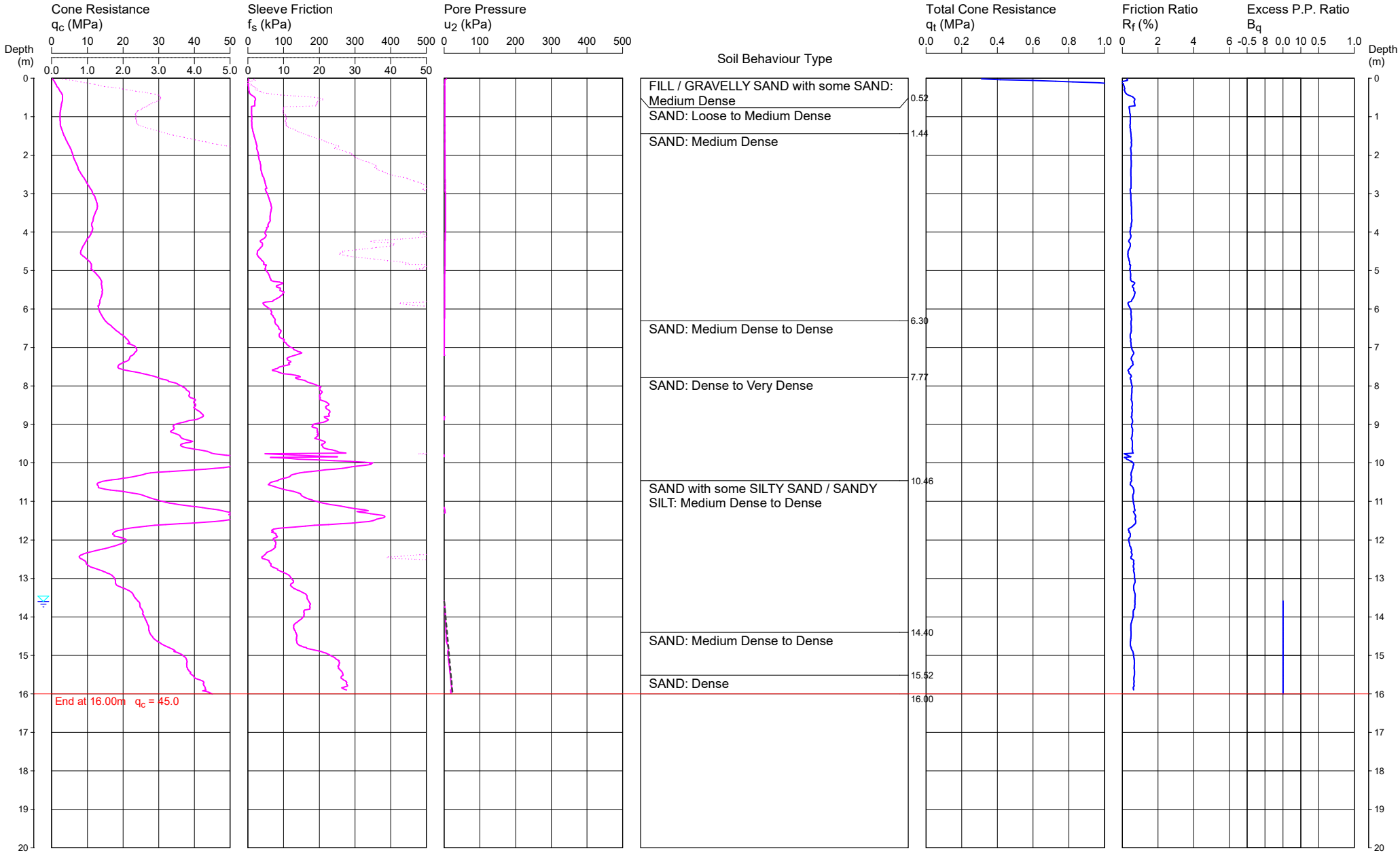
COORDINATES: 419564.8E 6379270.5N MGA2020 - Zone 56

402

Page 1 of 1

DATE 13/08/2025

PROJECT No: 227295.02



REMARKS: Hole discontinued due to cone tip refusal. Hole discontinued due to excessive rod string bowing. No water observed in CPT hole after withdrawal of rods. CPT hole open to at least 8 m depth after withdrawal of rods.

Water depth after test: 13.60m depth (assumed)

File: P:\227295.02 - NELSON BAY,5-7 Church & 42 Donald St,Geo\4.0 Field Work\4.2 Testing\402 (formerly 102).CP5

Cone ID: 240575 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: Fortezza Group Pty Ltd

PROJECT: Proposed Multistorey Residential Development

LOCATION: 5-7 Church & 42 Donald Street Nelson Bay

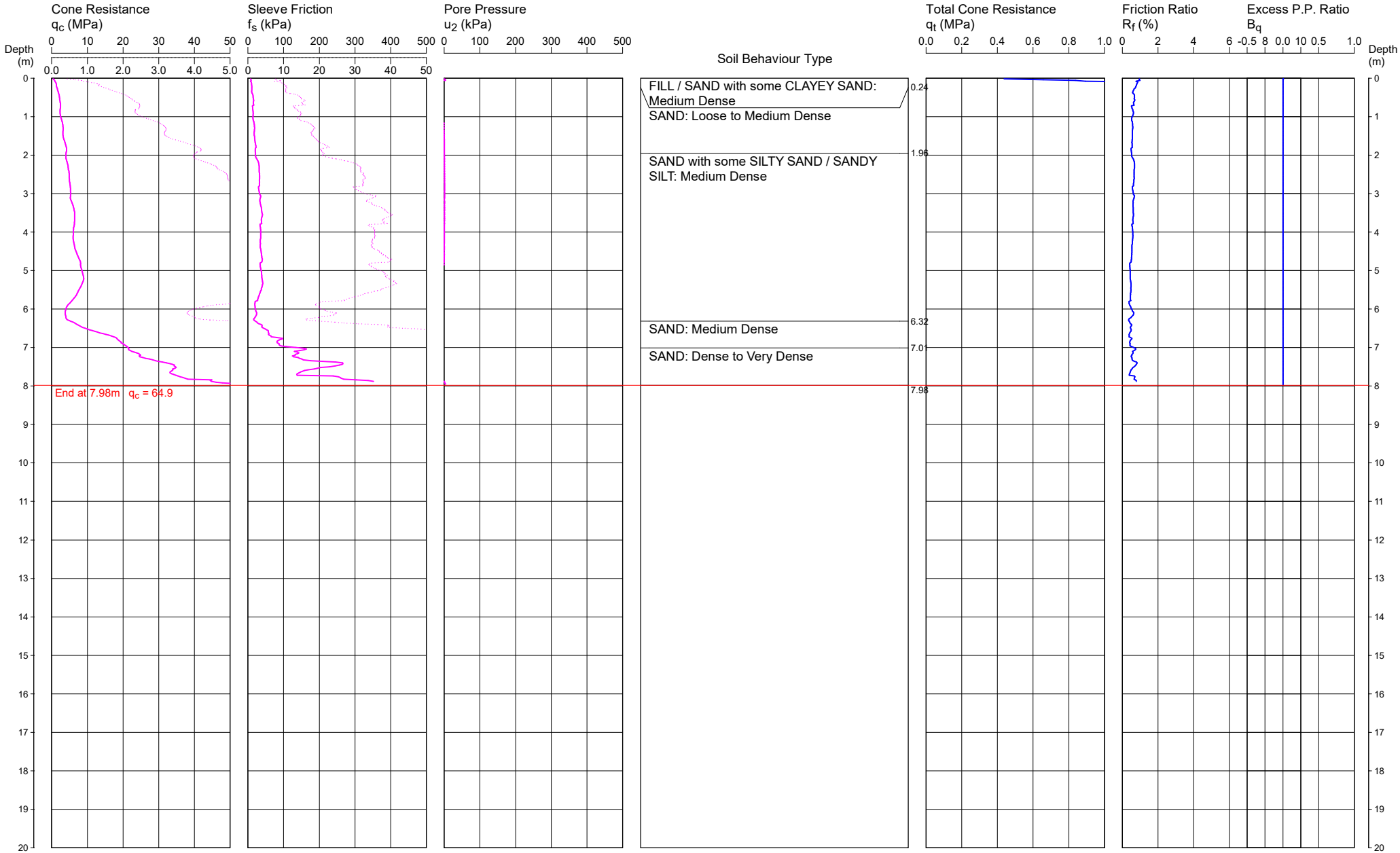
REDUCED LEVEL: 21.6 AHD

COORDINATES: 419588.7E 6379275.4N MGA2020 - Zone 56

403

DATE 12/08/2025

PROJECT No: 227295.02



REMARKS: Hole discontinued due to cone tip refusal. Hole discontinued due to excessive rod string bowing. No water observed in CPT hole after withdrawal of rods. CPT hole open to at least 8 m depth after withdrawal of rods.

File: P:\227295.02 - NELSON BAY,5-7 Church & 42 Donald St,Geo\4.0 Field Work\4.2 Testing\403 (formerly 103).CP5

Cone ID: 220516 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: Fortezza Group Pty Ltd

PROJECT: Proposed Multistorey Residential Development

LOCATION: 5-7 Church & 42 Donald Street Nelson Bay

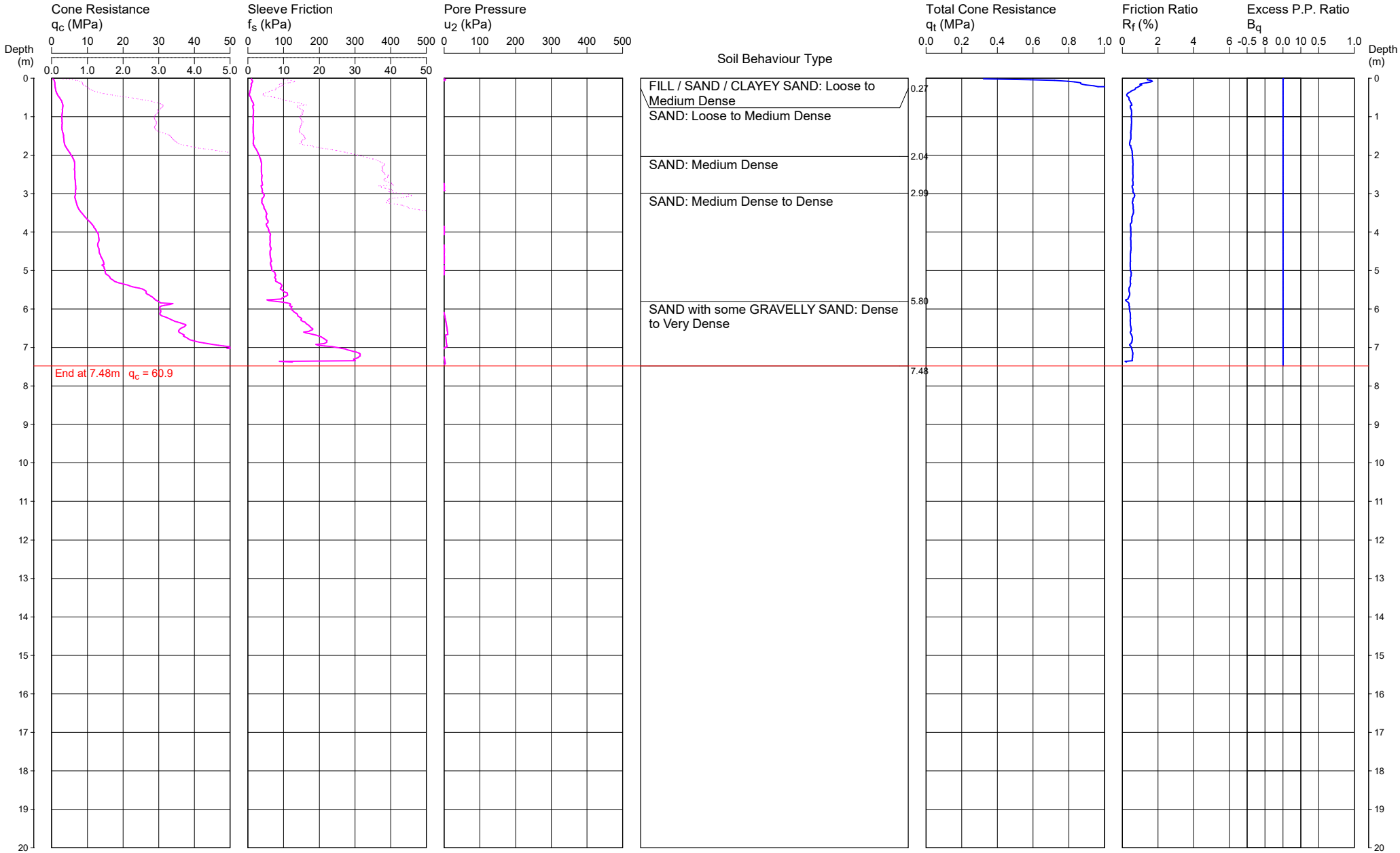
REDUCED LEVEL: 22.1 AHD

COORDINATES: 419587.6E 6379281.1N MGA2020 - Zone 56

404

DATE 12/08/2025

PROJECT No: 227295.02



REMARKS: Hole discontinued due to cone tip refusal. Hole discontinued due to excessive rod string bowing. No water observed in CPT hole after withdrawal of rods. CPT hole open to at least 7.48 m depth after withdrawal of rods.

File: P:\227295.02 - NELSON BAY,5-7 Church & 42 Donald St,Geo\4.0 Field Work\4.2 Testing\404 (formerly 104).CP5

Cone ID: 240575 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: Fortezza Group Pty Ltd

PROJECT: Proposed Multistorey Residential Development

LOCATION: 5-7 Church & 42 Donald Street Nelson Bay

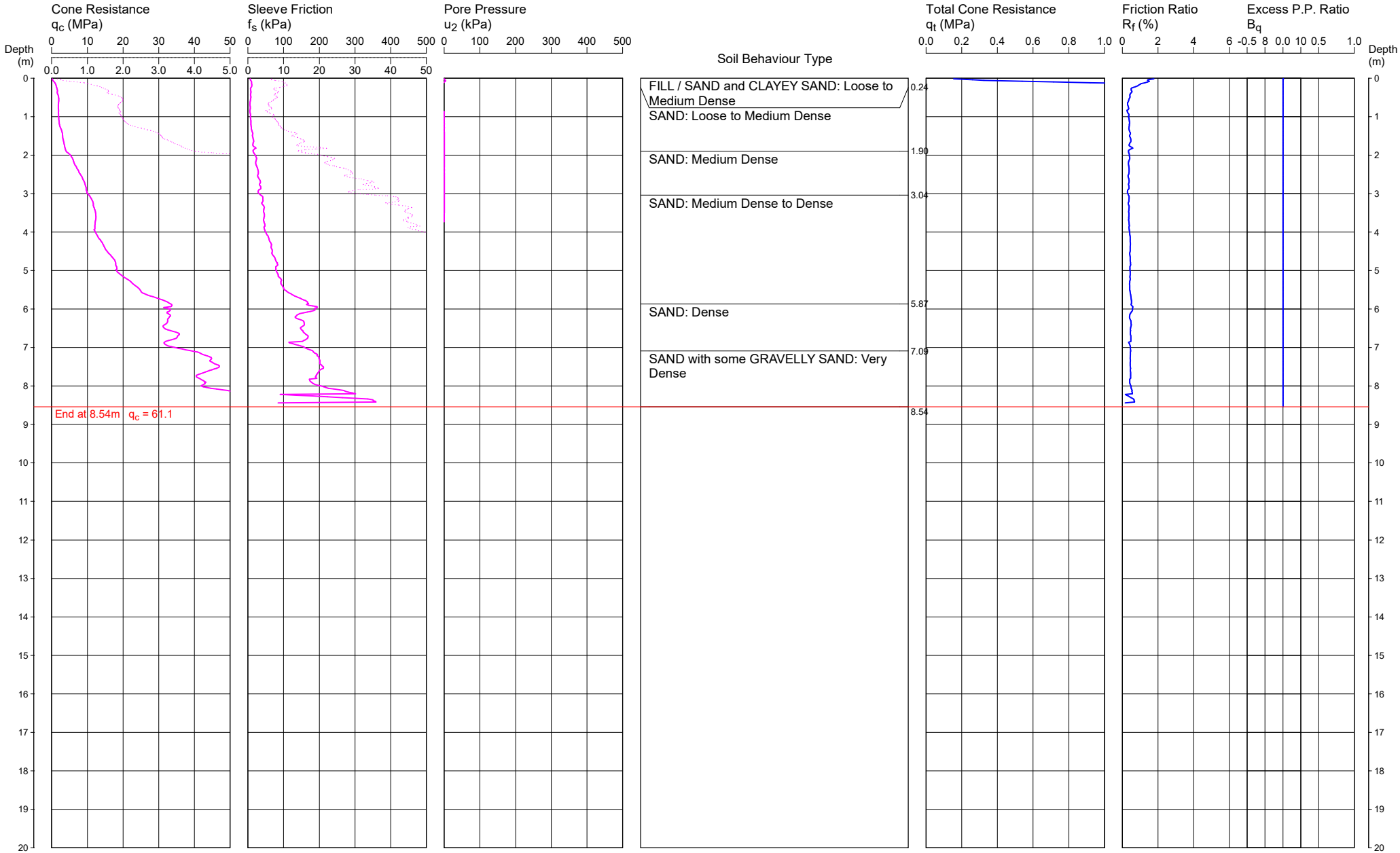
REDUCED LEVEL: 22.3 AHD

COORDINATES: 419591.1E 6379287.2N MGA2020 - Zone 56

405

DATE 12/08/2025

PROJECT No: 227295.02



REMARKS: Hole discontinued due to cone tip refusal. Hole discontinued due to excessive rod string bowing. No water observed in CPT hole after withdrawal of rods. CPT hole open to at least 8 m depth after withdrawal of rods.

File: P:\227295.02 - NELSON BAY,5-7 Church & 42 Donald St,Geo\4.0 Field Work\4.2 Testing\405 (formerly 105).CP5

Cone ID: 240573 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: Fortezza Group Pty Ltd

PROJECT: Proposed Multistorey Residential Development

LOCATION: 5-7 Church & 42 Donald Street Nelson Bay

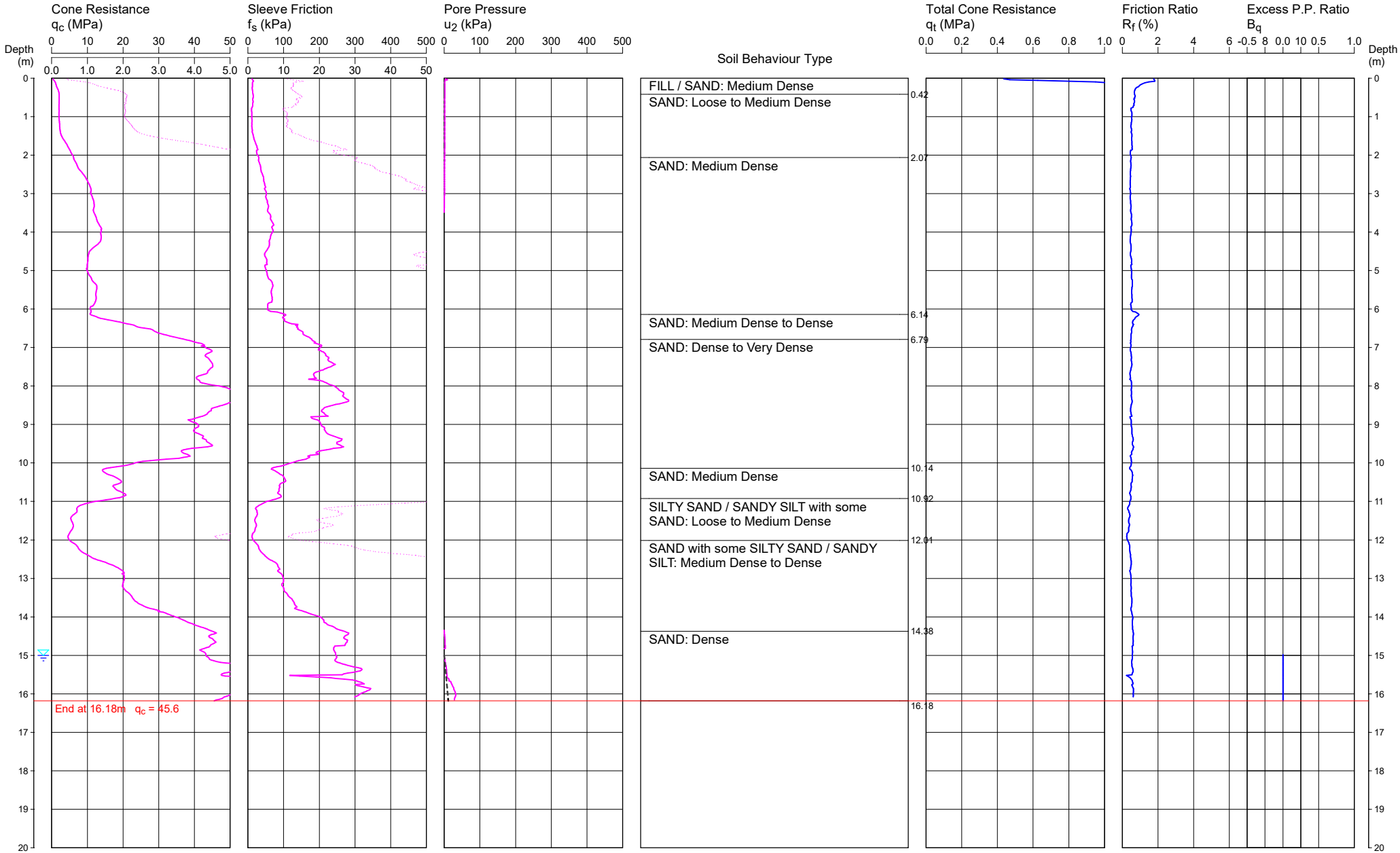
REDUCED LEVEL: 23.3 AHD

COORDINATES: 419582.4E 6379289.2N MGA2020 - Zone 56

406
Page 1 of 1

DATE 12/08/2025

PROJECT No: 227295.02



REMARKS: Hole discontinued due to excessive rod string bowing. No water observed in CPT hole after withdrawal of rods. CPT hole open to at least 8 m depth after withdrawal of rods.

Water depth after test: 15.00m depth (assumed)

File: P:\227295.02 - NELSON BAY,5-7 Church & 42 Donald St,Geo\4.0 Field Work\4.2 Testing\406 (formerly 106).CP5
Cone ID: 220516 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: Fortezza Group Pty Ltd

PROJECT: Proposed Multistorey Residential Development

LOCATION: 5-7 Church & 42 Donald Street Nelson Bay

REDUCED LEVEL: 24.3 AHD

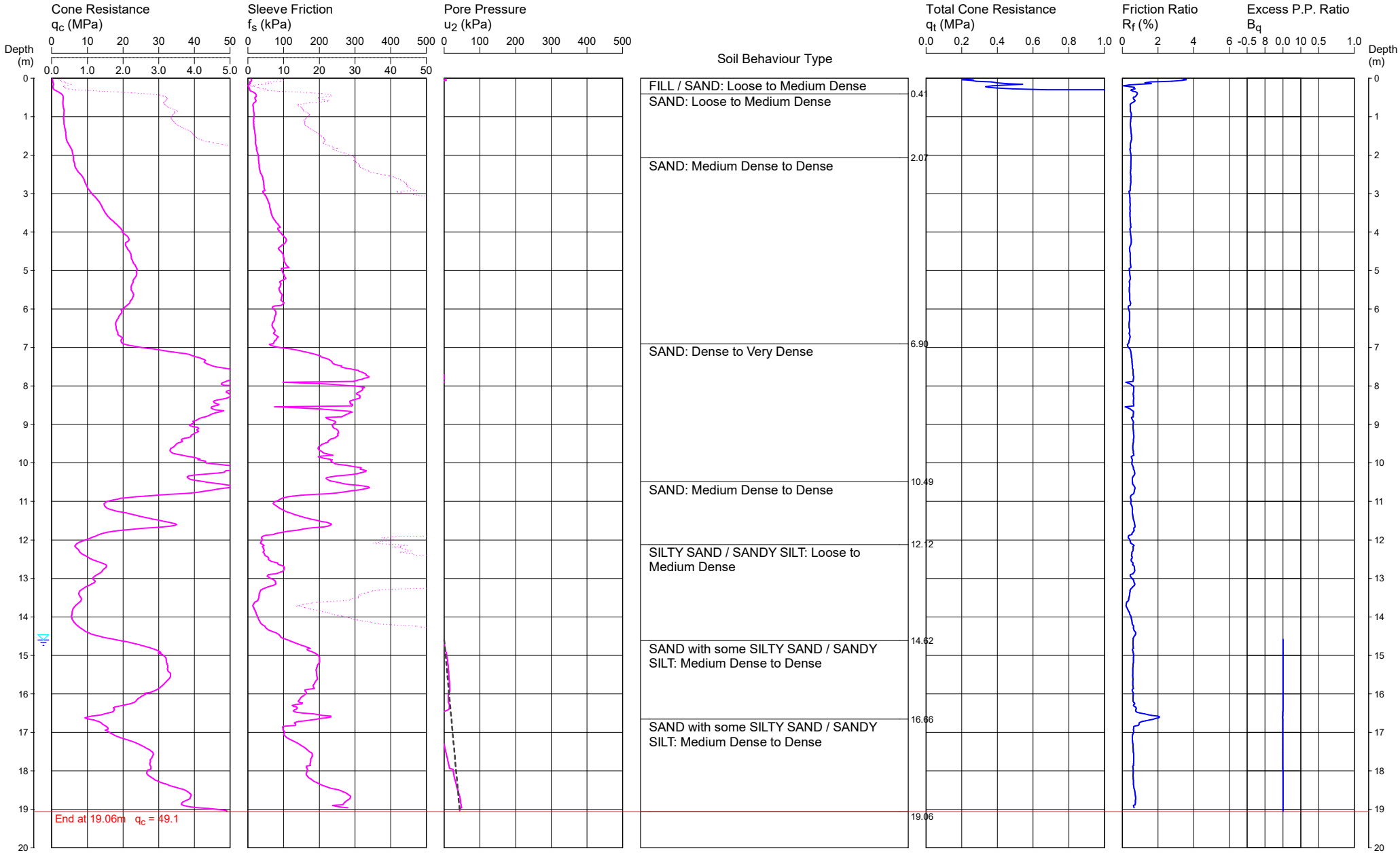
COORDINATES: 419566.0E 6379283.4N MGA2020 - Zone 56

407

Page 1 of 1

DATE 13/08/2025

PROJECT No: 227295.02



REMARKS: Hole discontinued due to cone tip refusal. Hole discontinued due to excessive rod string bowing. No water observed in CPT hole after withdrawal of rods. CPT hole open to at least 8 m depth after withdrawal of rods.

Water depth after test: 14.60m depth (assumed)

File: P:\227295.02 - NELSON BAY,5-7 Church & 42 Donald St,Geo\4.0 Field Work\4.2 Testing\407 (formerly 107).CP5

Cone ID: 240574 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: Fortezza Group Pty Ltd

PROJECT: Proposed Multistorey Residential Development

LOCATION: 5-7 Church & 42 Donald Street Nelson Bay

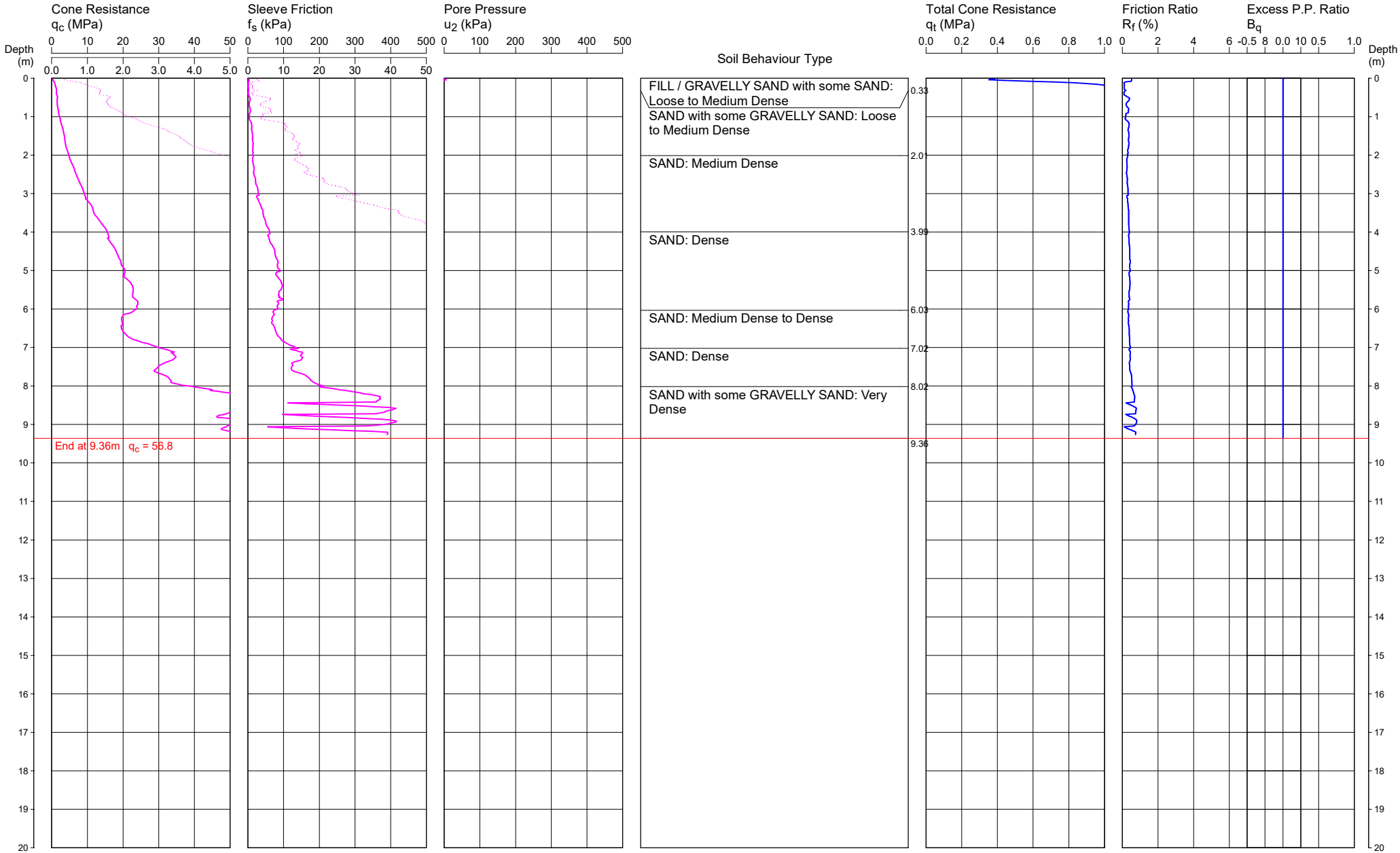
REDUCED LEVEL: 25.0 AHD

COORDINATES: 419554.1E 6379281.0N MGA2020 - Zone 56

408

DATE 13/08/2025

PROJECT No: 227295.02



REMARKS: Hole discontinued due to cone tip refusal. Hole discontinued due to excessive rod string bowing. No water observed in CPT hole after withdrawal of rods. CPT hole open to at least 8 m depth after withdrawal of rods.

File: P:\227295.02 - NELSON BAY,5-7 Church & 42 Donald St,Geo\4.0 Field Work\4.2 Testing\408 (formerly 108).CP5

Cone ID: 240573 **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Multistorey Residential Development
LOCATION: 5-7 Church & 42 Donald St, Nelson Bay, NSW

SURFACE LEVEL: 25.3 AHD
COORDINATE: E:419549.2, N:6379286.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 201
PROJECT No: 227295.01
DATE: 28/08/25
SHEET: 1 of 3

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL / WELL PIPE
28/08/25 No free groundwater observed	25	0.15	FILL / Silty SAND (SM): grey; fine to medium; with organics (rootlets); inclusions of brick, charcoal.		FILL	NA	M		D/ES		0.10	PID	<1ppm	Concrete
			SAND (SP): pale brown; fine to medium.						D/ES		0.50	PID	1ppm	Bentonite
	24	1							D/ES		1.00	PID	<1ppm	50mm Class 18 PVC Casing
	23	2	From 2.20m: brown		AEO	ND	M		D/ES		2.00	PID	<1ppm	
	22	3							D/ES		3.00	PID	<1ppm	Gravel
	21	4							D/ES		4.00	PID	<1ppm	

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe
OPERATOR: Tuck Environmental
LOGGED: Date
METHOD: Push Tube to 7.0m, Hollow Flight Auger to 12.0m
CASING: Uncased
REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of +/- 0.1 m, depending on satellite coverage and site condition.

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Multistorey Residential Development
LOCATION: 5-7 Church & 42 Donald St, Nelson Bay, NSW

SURFACE LEVEL: 25.3 AHD
COORDINATE: E:419549.2, N:6379286.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 201
PROJECT No: 227295.01
DATE: 28/08/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	20 / 6	[CONT] SAND (SP): pale brown; fine to medium.		AEO	ND	M		D/ES		5.00	PID	<1ppm		
								D/ES		5.50	PID	<1ppm		
	19 / 6.70							D/ES		6.00	PID	<1ppm		
		Silty SAND (SM): brown dark brown; fine to medium, (indurated sand).						D/ES		6.50	PID	<1ppm		
	7 / 18							D/ES		7.00	PID	<1ppm		
	8 / 17			AEO possibly ALV	ND	M		D/ES		8.00	PID	<1ppm		
	9 / 16									9				

Gravel
50mm Class 18 Machine Slotted PVC Screen

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe
OPERATOR: Tuck Environmental
LOGGED: Date
METHOD: Push Tube to 7.0m, Hollow Flight Auger to 12.0m
CASING: Uncased
REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of +/- 0.1 m, depending on satellite coverage and site condition.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Multistorey Residential Development
LOCATION: 5-7 Church & 42 Donald St, Nelson Bay, NSW

SURFACE LEVEL: 25.3 AHD
COORDINATE: E:419549.2, N:6379286.3
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 201
PROJECT No: 227295.01
DATE: 28/08/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	15		[CONT] Silty SAND (SM): brown dark brown; fine to medium, (indurated sand).						D/ES		10.00	PID	<1ppm	Gravel	
		11			AEO possibly ALV	ND	M				11				
	14								D/ES		11.50	PID	<1ppm		
		12	Borehole discontinued at 12.00m depth. Limit of investigation.												
	13														
		13													
	12														
		14													
	11														

NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe
OPERATOR: Tuck Environmental
LOGGED: Date
METHOD: Push Tube to 7.0m, Hollow Flight Auger to 12.0m
CASING: Uncased
REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of +/- 0.1 m, depending on satellite coverage and site condition.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Multistorey Residential Development
LOCATION: 5-7 Church & 42 Donald St, Nelson Bay, NSW

SURFACE LEVEL: 19.7 AHD
COORDINATE: E:419591.2, N:6379250.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 203
PROJECT No: 227295.01
DATE: 28/08/25
SHEET: 1 of 3

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL / WELL PIPE
		0.20	FILL / Silty SAND (SM) trace gravel: dark grey; fine to medium; sub-angular, natural gravel; inclusions of concrete, brick.		FILL	NA	M		D/ES		0.10	PID	6ppm	Concrete
	19		SAND (SP) with silt: grey; fine to medium; silt content decreases with depth; no hydrocarbon odour.						D/ES		0.50	PID	3ppm	Bentonite
		1			AEO	ND	M		D/ES		1.00	PID	<1ppm	50mm Class 18 PVC Casing
	18	1.70							D/ES		1.50	PID	2ppm	
			SAND (SP): pale grey; fine to medium; no hydrocarbon odour.											
		2							D/ES		2.00	PID	2ppm	
	17								D/ES		2.50	PID	2ppm	
		3							D/ES		3.00			Gravel
					AEO	ND	M							
	16													
		4							D/ES		4.00	PID	2ppm	
	15								D/ES		4.50	PID	<1ppm	

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe
OPERATOR: Tuck Environmental
LOGGED: Date
METHOD: Push Tube to 6.1m, Hollow Flight Auger to 10.1m
CASING: Uncased
REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of +/- 0.1 m, depending on satellite coverage and site condition.

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Multistorey Residential Development
LOCATION: 5-7 Church & 42 Donald St, Nelson Bay, NSW

SURFACE LEVEL: 19.7 AHD
COORDINATE: E:419591.2, N:6379250.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 203
PROJECT No: 227295.01
DATE: 28/08/25
SHEET: 2 of 3

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^]	DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	14		[CONT] SAND (SP): pale grey; fine to medium; no hydrocarbon odour.							D/ES		5.00	PID	3ppm		
	13	6	From 6.50m: grey		AEO	ND		M		D/ES		6.00	PID	2ppm		
	12	7								D/ES		7.00	PID	1ppm		
▼ Free groundwater observed at 8.0m 28/08/25		8						W		D/ES		8.00	PID	5ppm		
	11	8.50	Silty SAND (SP): dark brown; fine to medium, (indurated sand); no hydrocarbon odour.		AEO possibly ALV	ND		W		D/ES		9.00	PID	2ppm		
	10	9														

Backfill: Gravel; Well pipe: 50mm Class 18 Machine Slotted PVC Screen

NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe
OPERATOR: Tuck Environmental
LOGGED: Date
METHOD: Push Tube to 6.1m, Hollow Flight Auger to 10.1m
CASING: Uncased
REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of +/- 0.1 m, depending on satellite coverage and site condition.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: Fortezza Group Pty Ltd
PROJECT: Proposed Multistorey Residential Development
LOCATION: 5-7 Church & 42 Donald St, Nelson Bay, NSW

SURFACE LEVEL: 19.7 AHD
COORDINATE: E:419591.2, N:6379250.6
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 203
PROJECT No: 227295.01
DATE: 28/08/25
SHEET: 3 of 3

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
		[CONT] Silty SAND (SP): dark brown; fine to medium, (indurated sand); no hydrocarbon odour.		AEO possibly ALV	ND	W		D/ES		10.00	PID	2ppm		
		Borehole discontinued at 10.10m depth. Limit of investigation.												

NOTES: [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe
OPERATOR: Tuck Environmental
LOGGED: Date
METHOD: Push Tube to 6.1m, Hollow Flight Auger to 10.1m
CASING: Uncased
REMARKS: Coordinates and elevations measured by dGPS with typical accuracy of +/- 0.1 m, depending on satellite coverage and site condition.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Appendix C

Laboratory Test Results

Misc Inorg - Soil						
Our Reference		389940-6	389940-10	389940-11	389940-16	389940-19
Your Reference	UNITS	202	203	204	205	206
Depth		4	4	1	3	3.5
Date Sampled		28/08/2025	28/08/2025	29/08/2025	29/08/2025	29/08/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/09/2025	05/09/2025	05/09/2025	05/09/2025	05/09/2025
Date analysed	-	05/09/2025	05/09/2025	05/09/2025	05/09/2025	05/09/2025
pH 1:5 soil:water	pH Units	8.5	7.8	8.5	7.9	9.4
Electrical Conductivity 1:5 soil:water	µS/cm	33	10	12	6	42
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	<10	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	<10	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference		389940-23	389940-24	389940-25	389940-26	389940-27
Your Reference	UNITS	201	201	201	201	203
Depth		4	6	8	10	6
Date Sampled		28/08/2025	28/08/2025	28/08/2025	28/08/2025	28/08/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/09/2025	05/09/2025	05/09/2025	09/09/2025	09/09/2025
Date analysed	-	05/09/2025	05/09/2025	05/09/2025	09/09/2025	09/09/2025
pH 1:5 soil:water	pH Units	5.5	5.8	5.0	5.1	6.1
Electrical Conductivity 1:5 soil:water	µS/cm	6	3	15	13	4
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	<10	<10	10	10	<10

Misc Inorg - Soil			
Our Reference		389940-28	389940-29
Your Reference	UNITS	203	203
Depth		7	9
Date Sampled		28/08/2025	28/08/2025
Type of sample		Soil	Soil
Date prepared	-	09/09/2025	09/09/2025
Date analysed	-	09/09/2025	09/09/2025
pH 1:5 soil:water	pH Units	6.6	6.5
Electrical Conductivity 1:5 soil:water	µS/cm	8	14
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	<10	<10

Appendix D

Drawing 1 – Site and Test Location Plan

Site Location

Legend

- Approximate site boundary
- Approximate borehole location (current investigation)
- Approximate CPT location (current investigation)
- Approximate borehole location (Douglas 2024a)
- Approximate CPT location (Douglas 2024a)

NOTE:
1. Drawing adapted from aerial imagery from Metromap dated 20 July 2025.
2. Test locations are approximate only and were located using differential GPS typically accurate to ± 0.1 m depending on satellite coverage.

0 10 20 30 m

Douglas PARTNERS

CLIENT:	Fortezza Group Pty Ltd	TITLE:	**Test location plan**
OFFICE:	Newcastle	DRAWN BY:	SJG		**Proposed residential development**
SCALE:	1:400 @A3	DATE:	10.September.2025		**5-7 Church & 42 Donald Street, Nelson Bay NSW**

N

Project:	227295.02
DRAWING No:	D.001
REVISION:	0